

number of stations 100 and N is the number of endpoints 102 and the entries are the station 100 endpoint 102 pair  $T_{\min}$ . If the relationship between network latency and any external factors are well known and repeatable, multiple latency topology maps 130 may be generated for use as the network is affected by such external factors. For example, different latency topology maps 130 of whatever granularity desired may be used for different days of the week, such as business versus non-business days, or times of the day, such as peak daytime hours versus early morning hours.

$T_{\min}$  is measured between the ATBL 104 and each station 100 to the limit and probability desired within any time or resource constraints, step 240. A station-ATBL M-dimensional  $T_{\min}$  vector is then generated consisting of  $T_{\min}$  from each station 100 to the ATBL 104 in the same order as that used in the LTM 130, step 260.

Next the vector distance between the station-ATBL M-dimensional  $T_{\min}$  vector and each of the N station-endpoint M-dimensional  $T_{\min}$  vectors is calculated, step 280. Thus, the ATBL 104 is determined to be physically closest to the endpoint 102 whose corresponding station-endpoint M-dimensional  $T_{\min}$  vector is closest in vector space to the station-ATBL M-dimensional  $T_{\min}$  vector, step 300.

Vector distances can be computed using a variety of methods, to include but not limited to, such methods as the Euclidean and Mahalanobis.

Although various methods of the present invention have been described herein in detail to provide for complete and clear disclosure, it will be appreciated by those skilled in the art that variations may be made thereto without departing from the spirit of the invention or the scope of the appended claims.

What is claimed is:

1. A method for geolocating network equipment associated with a logical network

address on a communications network, comprising the steps of:

measuring a network latency from a plurality of network stations to a

plurality of network endpoints of known physical location by

pinging said network endpoints from said network stations multiple

times over a calibration period,

determining round-trip propagation times between each of said

network stations and each of said network endpoints over the

calibration period from said pinging, and

setting the network latency for each combination of said network

stations and said network endpoints to the corresponding

minimum round-trip propagation time determined for each of

said combination of said network stations and said network

endpoints;

measuring the network latency from each of said network stations to said

network equipment by

pinging said network equipment from said network stations,

determining the minimum round-trip propagation time between

each of said network stations and said network equipment, and

setting the network latency between each of said network stations

and said network equipment to the corresponding minimum

round-trip propagation time determined;

for each of said network endpoints arranging the network latency from the  
network endpoint to each of said network stations in turn, in a particular  
order, as vector elements in an endpoint vector;  
arranging the network latency from said network equipment to each of said  
network stations in turn, in said particular order, as vector elements in a  
network equipment vector;  
determining a distance between the network equipment vector and each of  
the endpoint vectors; and  
identifying the physical location of the network equipment as proximate to  
said known physical location of the network endpoint corresponding to  
the endpoint vector having said distance to the network equipment  
vector not greater than the distance from any other of the endpoint  
vectors to the target equipment vector.

2. A method for verifying that the geolocation of network equipment associated  
with a logical network address on a communications network is consistent with  
network equipments associated with vetted geolocations, comprising the steps  
of:

measuring a network latency from a plurality of network stations to at least  
one piece of network equipment associated with vetted geolocations by  
pinging each of said network equipments associated with vetted  
geolocations from said network stations multiple times over a  
calibration period,

determining round-trip propagation times between each of said  
network stations and each of said network equipments  
associated with vetted geolocations over the calibration period  
from said pinging, and

5        setting the network latency for each combination of said network  
stations and said network equipments associated with vetted  
geolocations to the corresponding minimum round-trip  
propagation time determined for each of said combination of  
said network stations and said network equipments associated  
with vetted geolocations;

10        measuring the network latency from each of said network stations to said  
network equipment by

15        pinging said network equipment from said network stations,  
determining the minimum round-trip propagation time between  
each of said network stations and said network equipment, and  
20        setting the network latency between each of said network stations  
and said network equipment to the corresponding minimum  
round-trip propagation time determined;

25        for each of said network equipments associated with vetted geolocations  
arranging the network latency from each of said network equipments  
associated with vetted geolocations to each of said network stations in  
turn, in a particular order, as vector elements in a vetted equipment  
vector;

arranging the network latency from said network equipment to each of said  
network stations in turn, in said particular order, as vector elements in a  
network equipment vector;  
determining a distance between the network equipment vector and each of  
the vetted equipment vectors; and  
determining if the physical location of the network equipment is proximate  
to one of said network equipments associated with vetted geolocations.

3. A method for geolocating network equipment associated with a logical network  
address on a communications network as recited in claim 1, further comprising  
the additional step of determining if said distance to the network equipment  
vector not greater than the distance from any other of the endpoint vectors to  
the target equipment vector is within a user defined threshold.
4. A method for geolocating network equipment associated with a logical network  
address on a communications network as recited in claim 3, wherein said steps  
of:  
measuring a network latency from a plurality of network stations to a  
plurality of network endpoints of known physical location;  
measuring the network latency for each of said network stations to said  
network equipment;

for each of said network endpoints arranging the network latency from the  
network endpoint to each of said network stations in turn, in a particular  
order, as vector elements in an endpoint vector;  
arranging the network latency from said network equipment to each of said  
network stations in turn, in said particular order, as vector elements in a  
network equipment vector; and  
determining a distance between the network equipment vector and each of  
the endpoint vectors;

are repeated in iteration using additional of said network endpoints until said  
distance to the network equipment vector not greater than the distance from  
any other of the endpoint vectors to the target equipment vector is within said  
user defined threshold.

5. A method for geolocating network equipment associated with a logical network  
address on a communications network as recited in claim 3, wherein said steps  
of:

measuring a network latency from a plurality of network stations to a  
plurality of network endpoints of known physical location;  
measuring the network latency for each of said network stations to said  
network equipment;

for each of said network endpoints arranging the network latency from the  
network endpoint to each of said network stations in turn, in a particular  
order, as vector elements in an endpoint vector;

arranging the network latency from said network equipment to each of said  
network stations in turn, in said particular order, as vector elements in a  
network equipment vector; and  
determining a distance between the network equipment vector and each of  
the endpoint vectors;

are repeated in iteration using a different set of said network endpoints until  
said distance to the network equipment vector not greater than the distance  
from any other of the endpoint vectors to the target equipment vector is within  
said user defined threshold.

6. A method for geolocating network equipment associated with a logical network  
address on a communications network as recited in claim 3, wherein said steps  
of:

measuring a network latency from a plurality of network stations to a  
plurality of network endpoints of known physical location;  
for each of said network endpoints arranging the network latency from the  
network endpoint to each of said network stations in turn, in a particular  
order, as vector elements in an endpoint vector;  
arranging the network latency from said network equipment to each of said  
network stations in turn, in said particular order, as vector elements in a  
network equipment vector; and  
determining a distance between the network equipment vector and each of  
the endpoint vectors;

are repeated in iteration until said distance to the network equipment vector not greater than the distance from any other of the endpoint vectors to the target equipment vector is within said user defined threshold.

- 5 7. A method for geolocating network equipment associated with a logical network address on a communications network as recited in claim 3, wherein said steps of:

measuring the network latency for each of said network stations to said network equipment;

10 arranging the network latency from said network equipment to each of said network stations in turn, in said particular order, as vector elements in a network equipment vector; and

determining a distance between the network equipment vector and each of the endpoint vectors;

15 are repeated in iteration until said distance to the network equipment vector not greater than the distance from any other of the endpoint vectors to the target equipment vector is within said user defined threshold.

- 20 8. A method for geolocating network equipment associated with a logical network address on a communications network as recited in claim 1, wherein said calibration period extends to all previous measuring of said network latency.



9. A method for geolocating network equipment associated with a logical network address on a communications network as recited in claim 1, wherein said calibration period extends back only a user determined amount of time.
- 5 10. A method for geolocating network equipment associated with a logical network address on a communications network as recited in claim 1, wherein said communications network is the Internet.
11. A method for geolocating network equipment associated with a logical network address on a communications network as recited in claim 1, wherein said steps of:
- measuring a network latency from a plurality of network stations to a plurality of network endpoints of known physical location; and
  - for each of said network endpoints arranging the network latency from the network endpoint to each of said network stations in turn, in a particular order, as vector elements in an endpoint vector;
- are performed based on particular sets of user defined external factors and also further comprising the additional step of saving said arranged endpoint vector.